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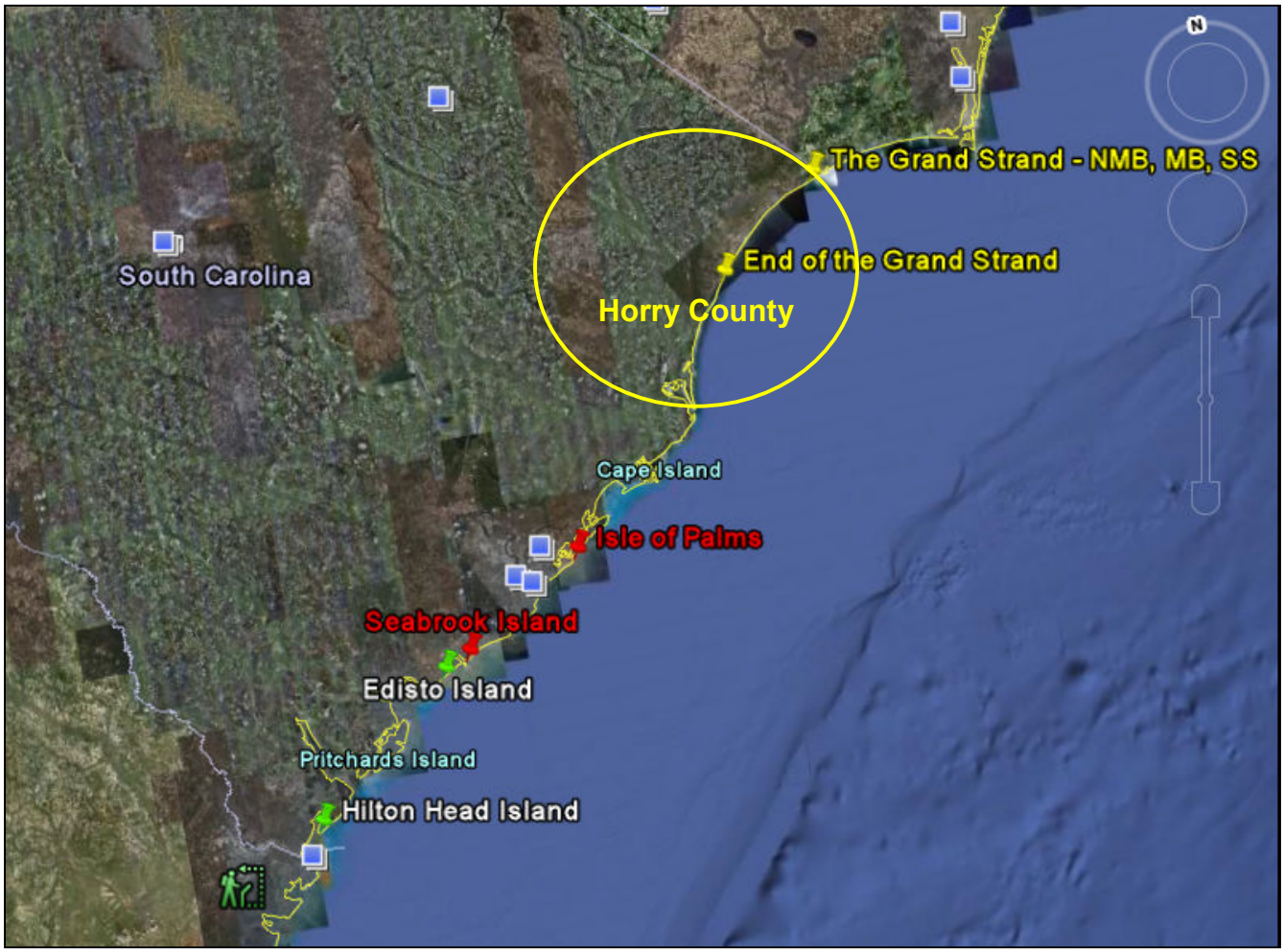
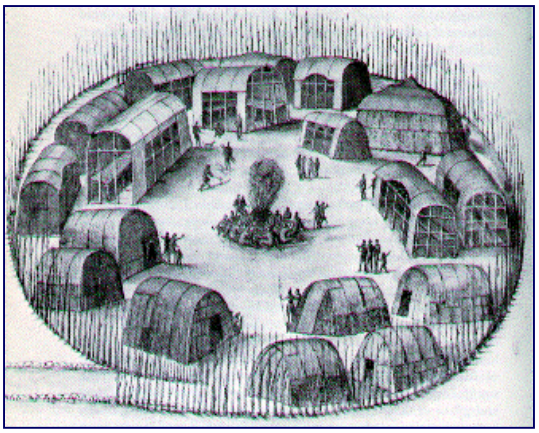
South Carolina Department of Health and Environmental Control

Stormwater: History and Remediation in Horry County, S.C.



This paper was presented to the National Beaches Conference held in Huntington Beach California in April 2009.
http://www.epa.gov/waterscience/beaches/meetings/2009/index.htm

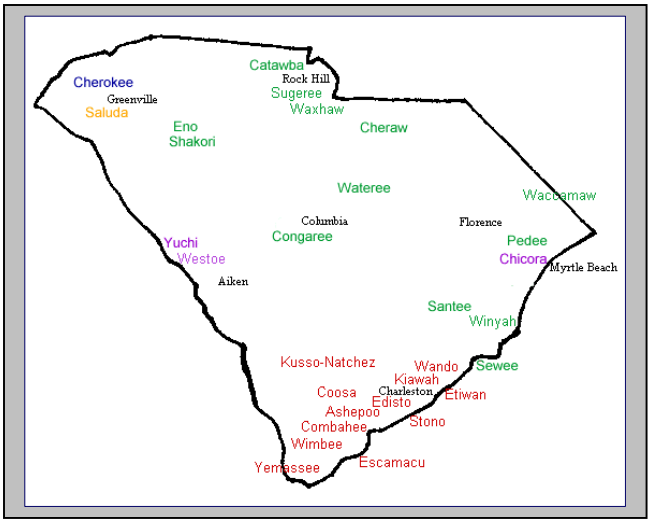
This paper describes the work of the cities, the county, interested citizens, and our EPA grant in the effort to improve water quality along the coast.



Carolina Indian village

Horry County has been inhabited for at least ten thousand years. The area that is today Horry County was once the home of the Waccamaw tribe, a Siouan people.

Peter Horry



Horry is one of the largest counties in the Eastern U.S. at over 1100 square miles. It is drained by the Waccamaw and the Pee Dee Rivers. These rivers and the Intercoastal Waterway divide the beaches on the Atlantic from other land areas.

Horry County before 1954.

Horry County is a low, sandy area, which supports dense stands of long-leaf pine, which supported the production of Naval Stores. From the earliest days of Horry County's history up until the latter half of the 19th Century, the naval stores industry was prominent in Horry County. The seemingly inexhaustible supply of pitch, pine tar, turpentine, and a variety of other naval products supplied many Horry County citizens with the majority of their income until the industry tapped out all of the natural resources needed for the production of naval stores and moved southward in the late 1800s.

From the time of the American Revolution to the mid 1950's, Horry County was primarily rural with most people involved in either timber or agriculture. The South Carolina coast was dotted with single-family homes and a few hotels.

Rainwater and stormwater collected in low areas, which drained naturally to the ocean. These natural swashes still exist today.

Ocean Forest Hotel, Myrtle Beach
(Courtesy of the South Caroliniana Library, University of South Carolina)

Example of single family home.

In 1954 Hurricane Hazel, a category 4 storm, severely damaged the S.C. coast in Horry County. In the aftermath, developers including Burroughs and Chapin saw potential in the area. The development of the Grand Strand began.

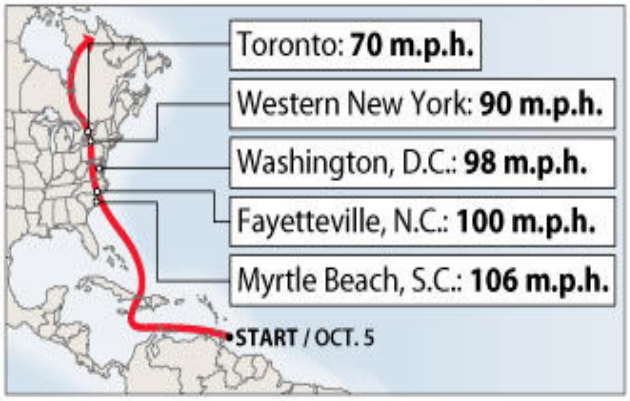
From the tropics to Toronto: Hurricane Hazel's deadly October 1954 trek

Fifty-three years ago today on Oct. 15, 1954, a high-end Category 4 Hurricane Hazel, packing top winds of 150 m.p.h., slammed ashore just north of Myrtle Beach, S.C. Contrary to most landfalling hurricanes that rapidly weaken once robbed of their warm-ocean energy source, Hazel's winds retained hurricane strength while the storm accelerated to the northeast at speeds approaching 60 m.p.h. Though rapidly losing its tropical characteristics, Hazel combined with low pressure moving east from the Plains to create a monster storm with 100 m.p.h. wind gusts and torrential rainfall that cut a swath of death and destruction from the Carolinas to near Toronto in just a 12-hour time span.

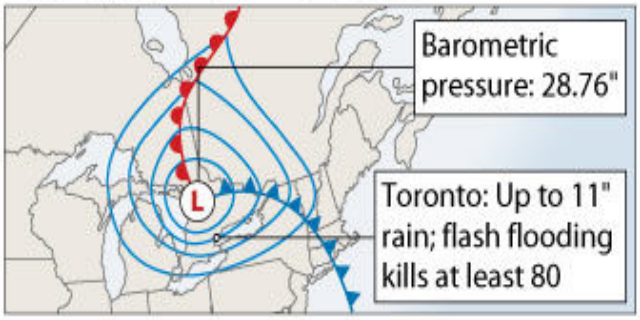
Storm's final phases were as just as deadly as its beginning

Hazel formed east of the Windward Islands on Oct. 5, quickly reaching hurricane strength. As it passed across the mountainous southwest Haitian peninsula, a combination of high winds and waves along with torrential rain triggered mudslides and flooding that claimed between 400 to 1,000 lives. Once passing Haiti, dangerous Hazel took dead aim at the Carolinas. In addition to the deaths in Haiti, Hazel killed nearly 200 in the U.S and Canada, and caused damage approaching $400 million.

HAZEL TRACK: OCT. 5-18
With peak wind gusts along its path



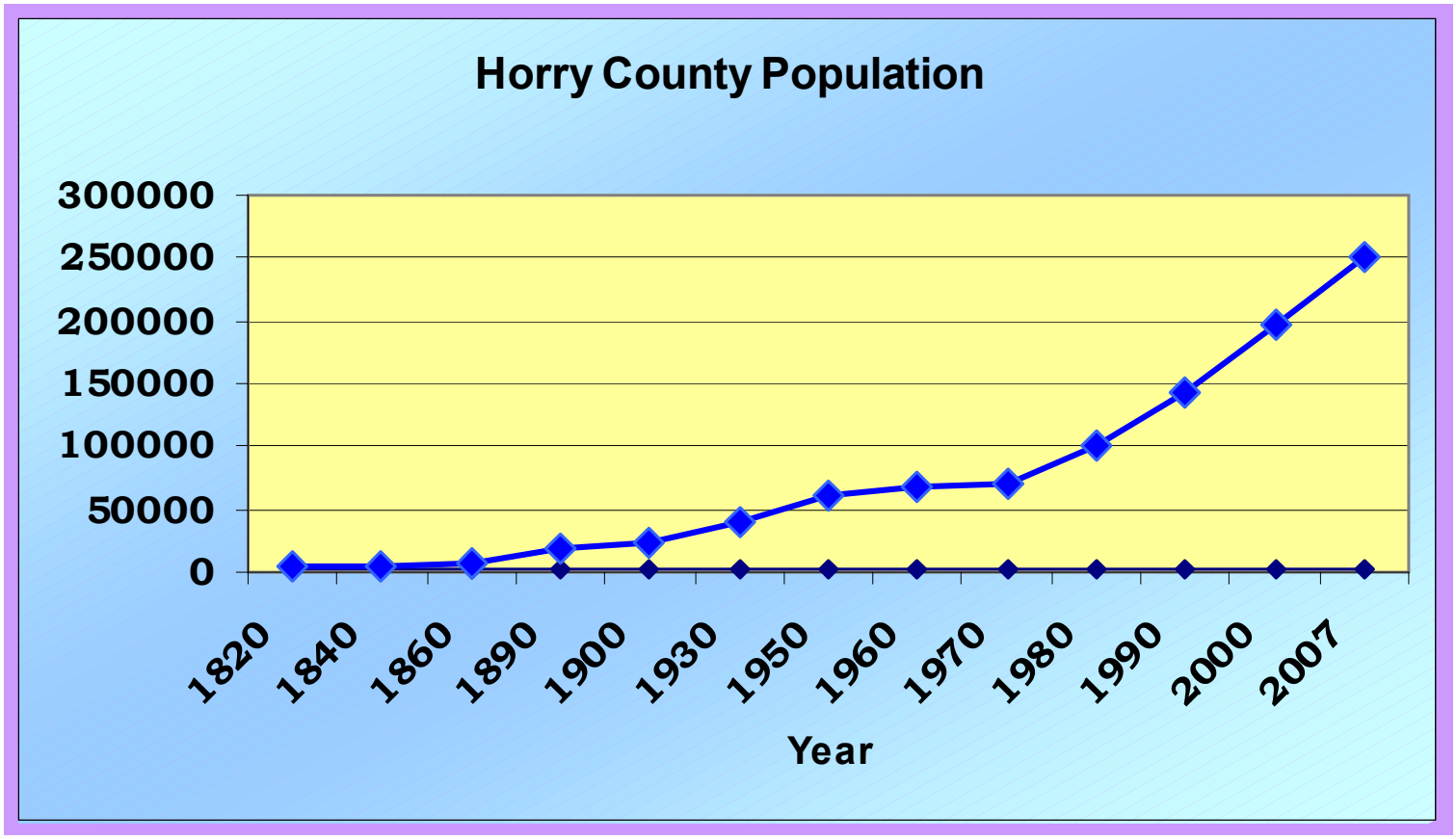
INTENSE STORM RACED TO CANADA OCT. 15-16
Weather pattern and wind isobars



Sources: Tropical Prediction Center, NOAA, National Weather Service archives

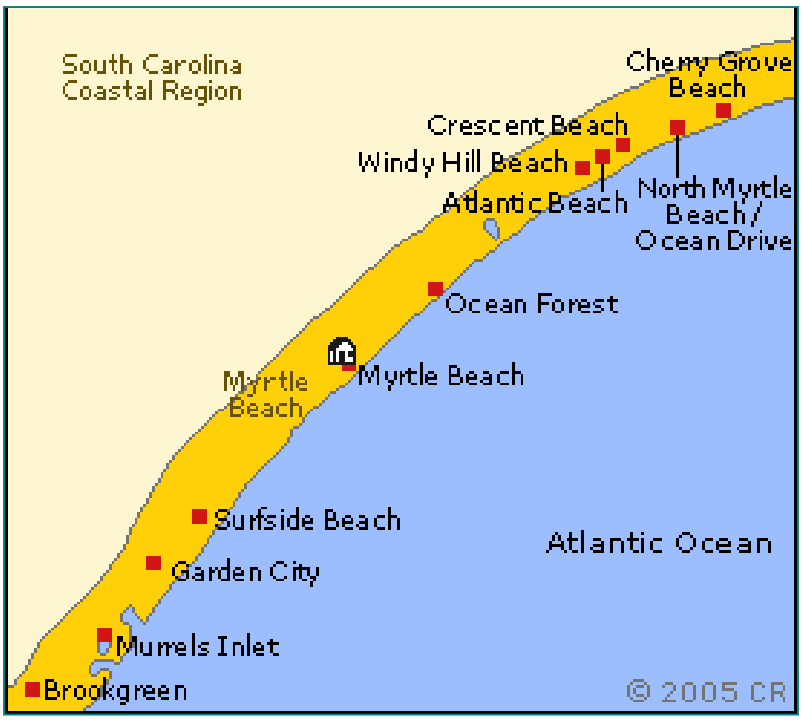
WGN-TV/Steve Kahn

From a small town to a major resort and tourist destination in less than 25 years, this is what occurred in Horry County in the last half of the 20th century.



- Myrtle Beach incorporated 1938
- Hurricane Hazel 1954 – Category 4
- Surfside incorporated 1964
- Atlantic Beach incorporated 1966
- North Myrtle Beach incorporated 1968

Tourist population in 2006 was 14.6 million

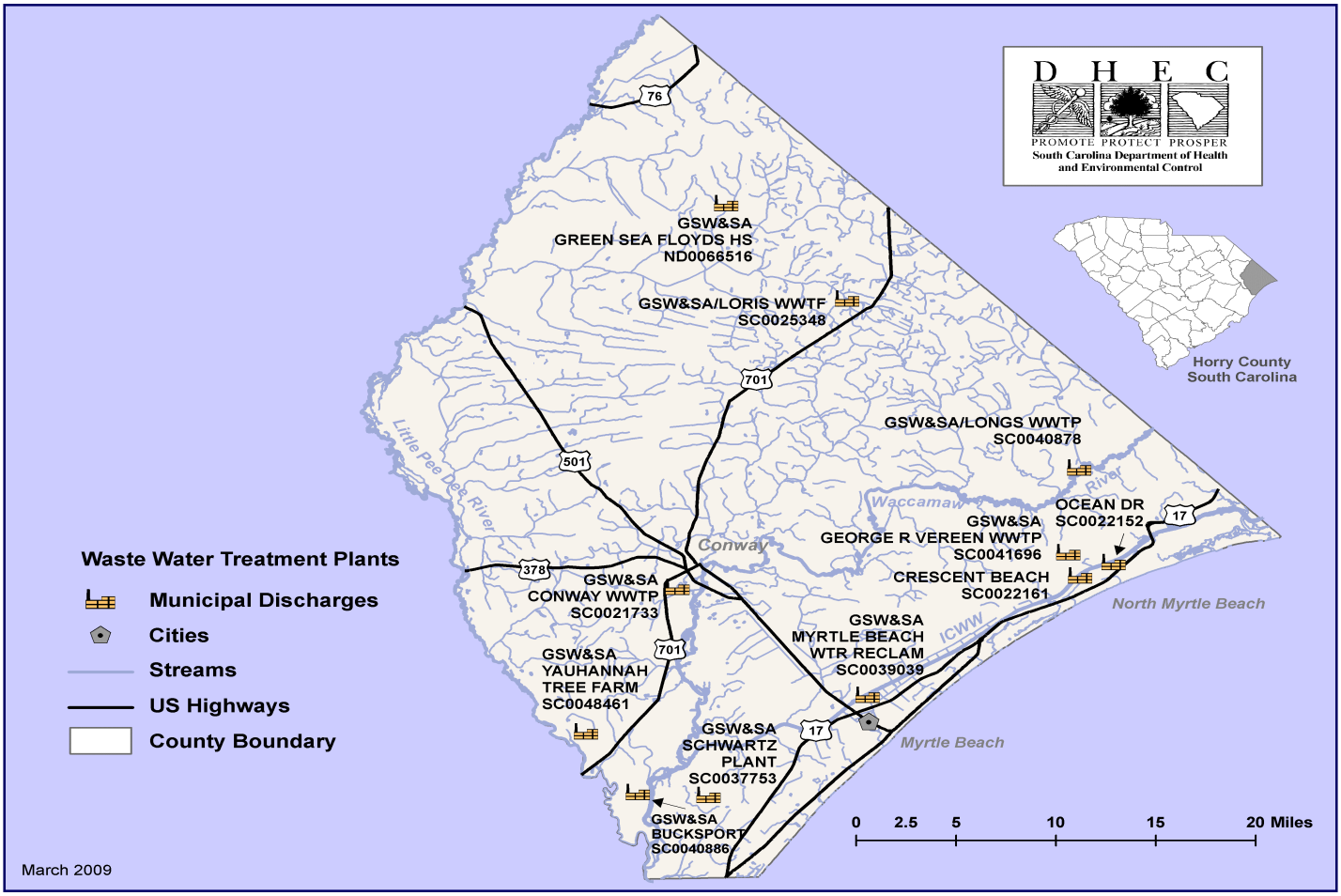


The Grand Strand is the SC coast from North Myrtle Beach in the north to Surfside Beach in the south.

The towns of Cherry Grove, Crescent Beach, Windy Hill and Ocean Drive merged to form the City of North Myrtle Beach.

The Grand Strand 2009

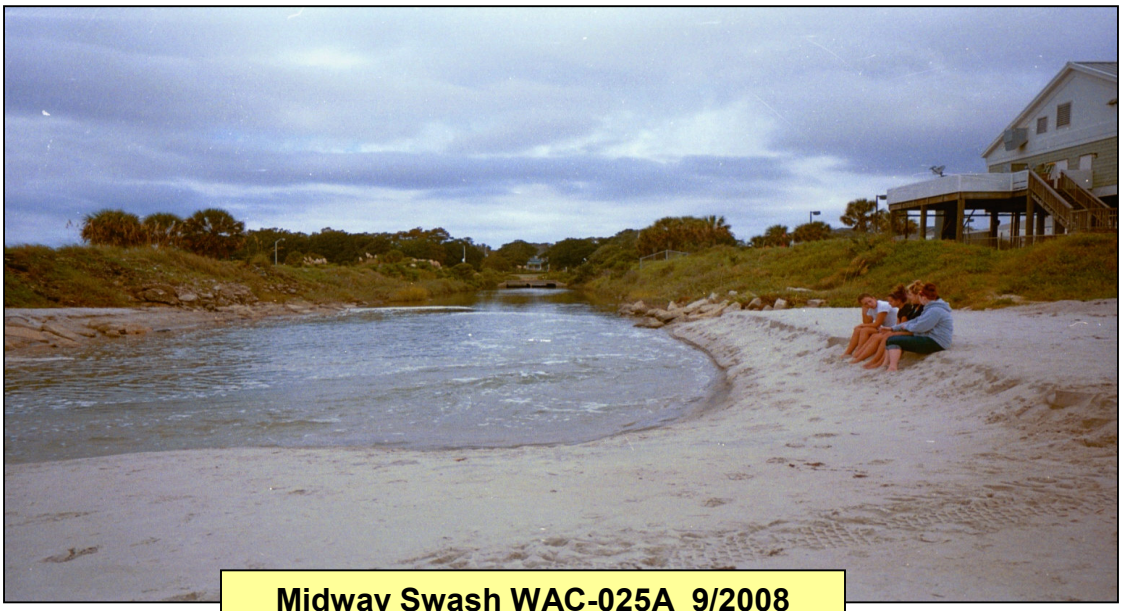
Many family homes were on septic tanks prior to the development of the Grand Strand. Today most single-family homes have been replaced with hotels and resorts and the septic systems have been replaced with city sewers.



There are no wastewater outfalls to the ocean in Horry County or in South Carolina. All wastewater discharges in Horry County go to the Intercoastal Waterway or to the Waccamaw or Socastee Rivers. Residents of the Grand Strand no longer have septic systems; businesses and homes are tied into the county or city sewer system.

However, as the cities developed, stormwater was piped onto the beach. Some of these pipes remain as do the swashes. The remainder of this paper will discuss the issues involved in stormwater remediation in Horry County.

What is a swash? It is a flow of water onto the beach from a natural source. Midway Swash is between 23rd Ave. South in the City of Myrtle Beach and Springmaid Beach.



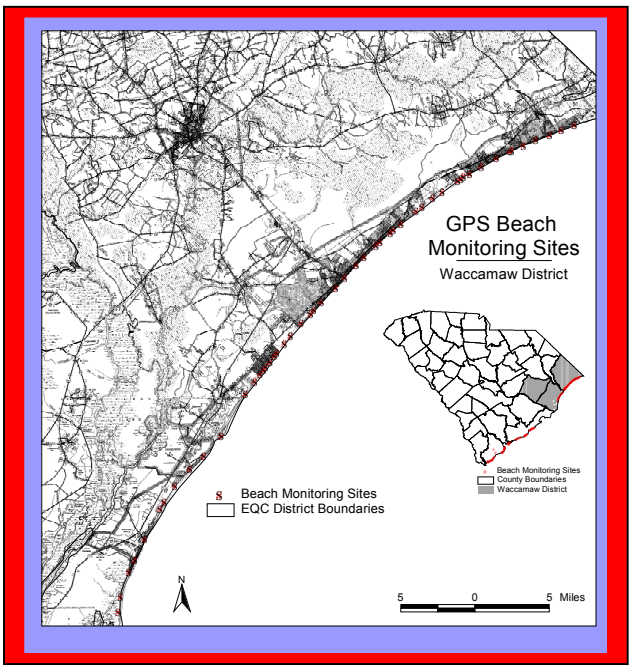
Midway Swash WAC-025A 9/2008

As the Grand Strand developed, people built homes around the existing lagoons and ponds. These are some of the homes around Withers Swash in the City of Myrtle Beach at low tide. There is a park and playground on the side of the pond with the gazebo.

This is Withers Swash as it goes under Highway 17 on its way to the ocean.

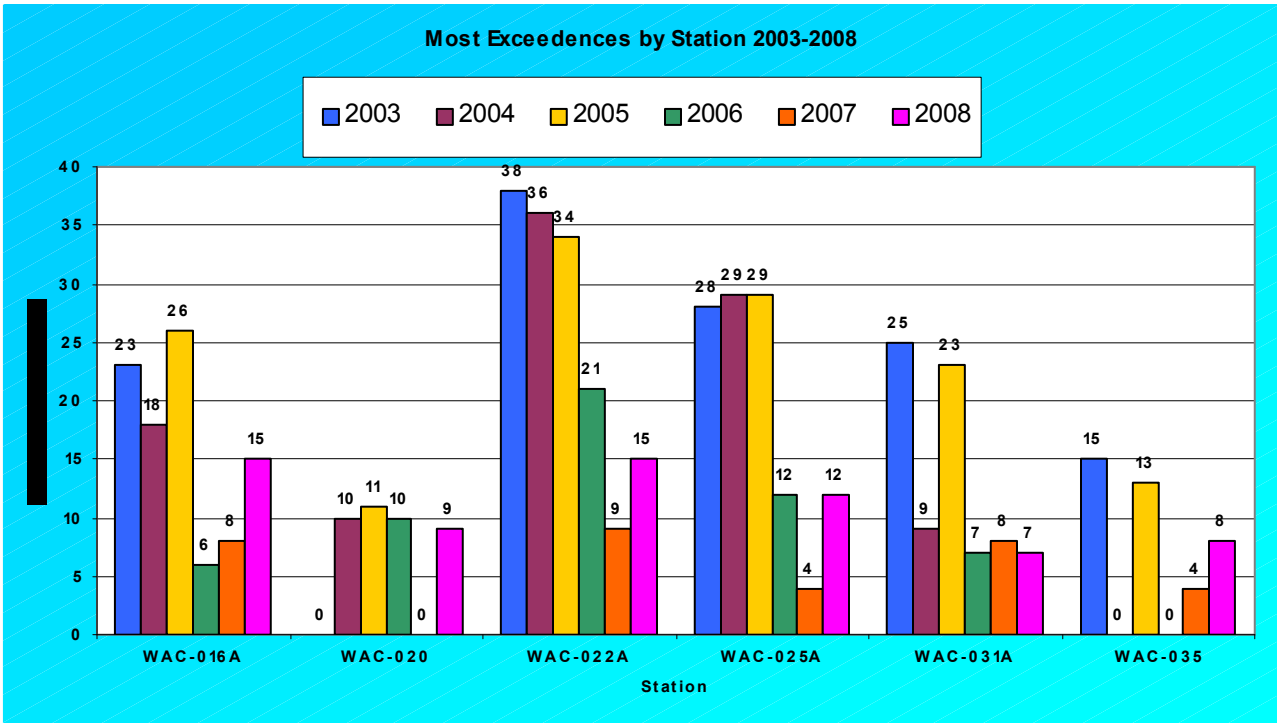
Stormwater pipes drain runoff to the ocean as well.

As stormwater drains into the ponds and then through swashes or through pipes to the ocean, bacteria collect in the water, which can cause illness. After rain, the bacteria count in the ocean is often higher than normal.



The red dots represent stormwater outfalls.

Ocean water samples are taken weekly at 41 stations from North Myrtle Beach to Surfside Beach during the beach season – May 15th to October 15th. The City of Myrtle Beach also samples every week, all year long. The stations with the most exceedences historically have been:



WAC-016A is Canes Patch Swash
WAC-022A is Withers Swash
WAC-025A is Midway Swash
WAC-031A is the swash at 5th Avenue N in Surfside Beach.

Each level of government in S.C. is working on the issues of stormwater runoff in Horry County and its relationship to public health. Here are some of the things that have happened since 2001.

First, the pipes are beginning to be removed from the beaches and there are plans to remove most of them within the next 5 to 10 years. The pictures that follow on the next page show the results of extending the pipes out into the ocean 1000 feet. This was done at WAC-005A (7th Ave. S) by the City of North Myrtle Beach and at WAC-017A (Deep Head Swash) by the City of Myrtle Beach. These projects cost millions of dollars.

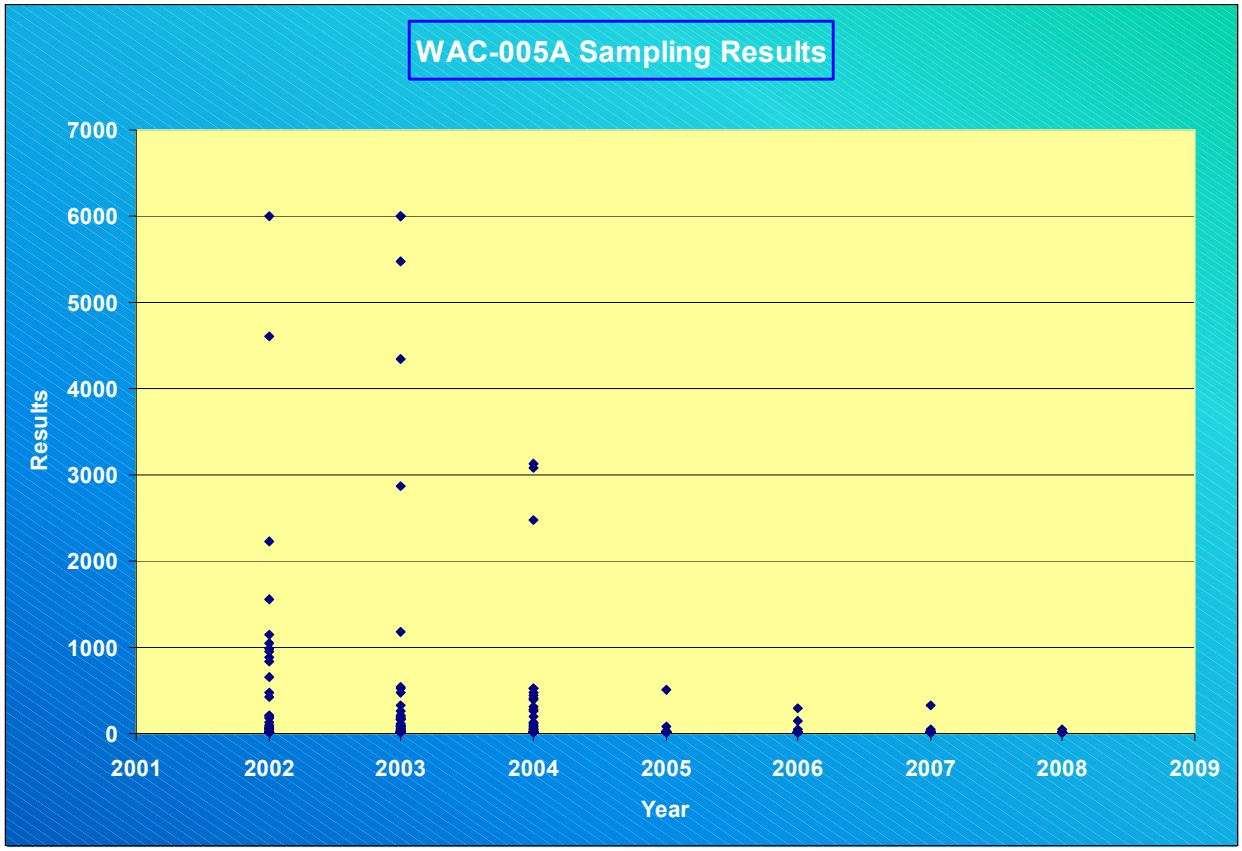
This is the project in progress at WAC-005A.

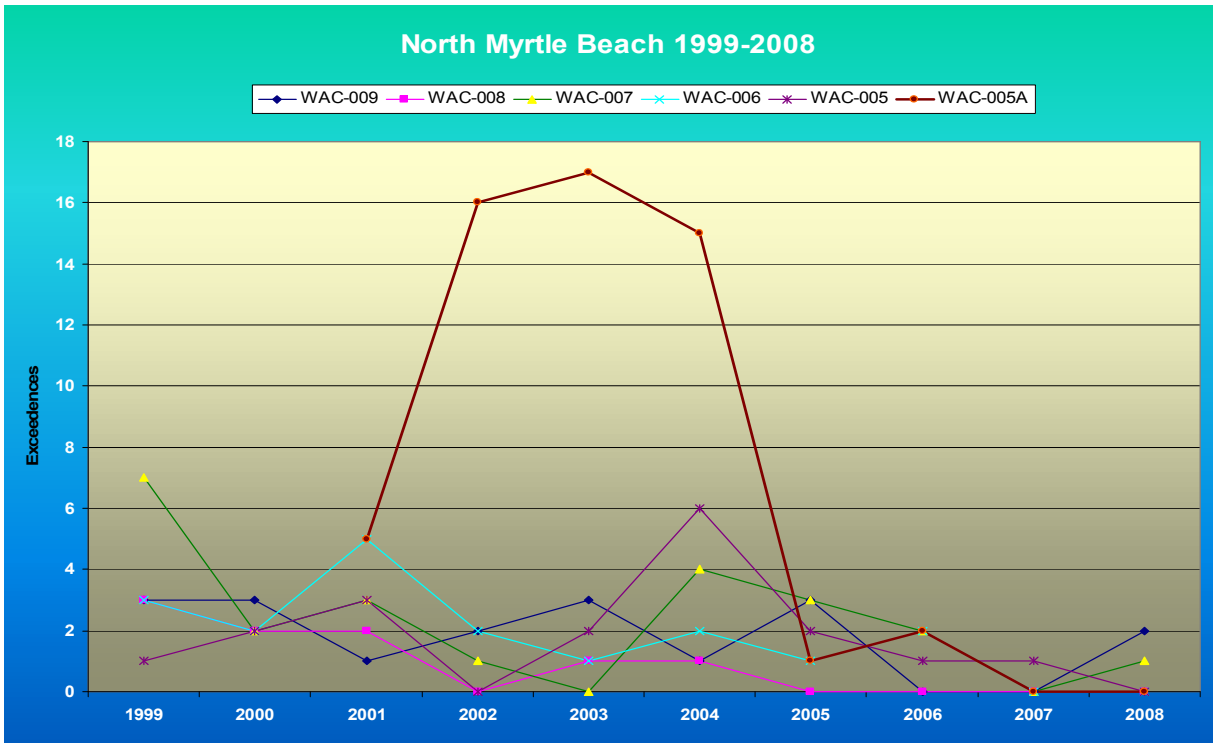
Before

After

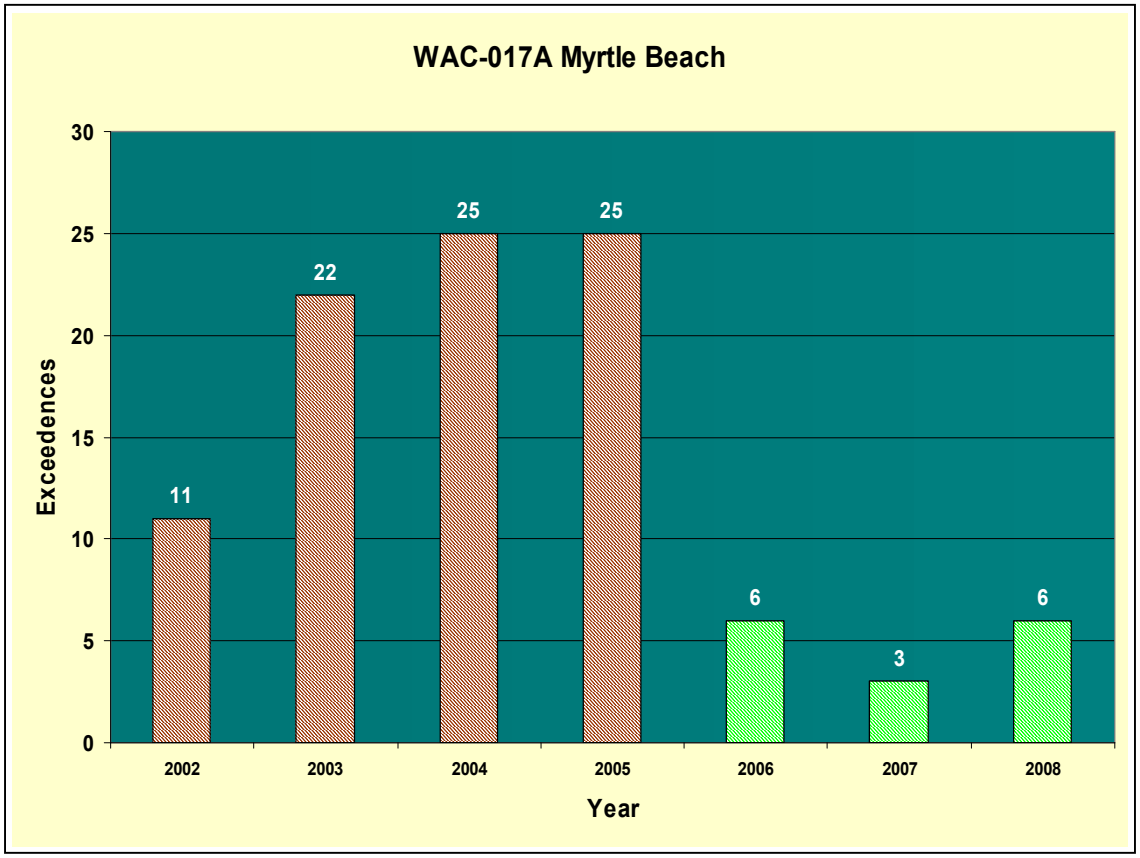
WAC-017A – Deep Head Swash before pipe extension project

The sampling data for these stations shows the benefit to public health.


WAC-005A Sampling Results
7000
6000
5000
4000
3000
2000
1000
0
Results
2001
2002
2003
2004
2005
2006
2007
2008
2009
Year


North Myrtle Beach 1999-2008
WAC-009
WAC-008
WAC-007
WAC-006
WAC-005
WAC-005A
18
16
14
12
10
8
6
4
2
0
Exceedences
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008

The number of samples exceeding 104 CFU/100mL dropped significantly after the pipe was installed. The results for WAC-017A are the same and are shown below.

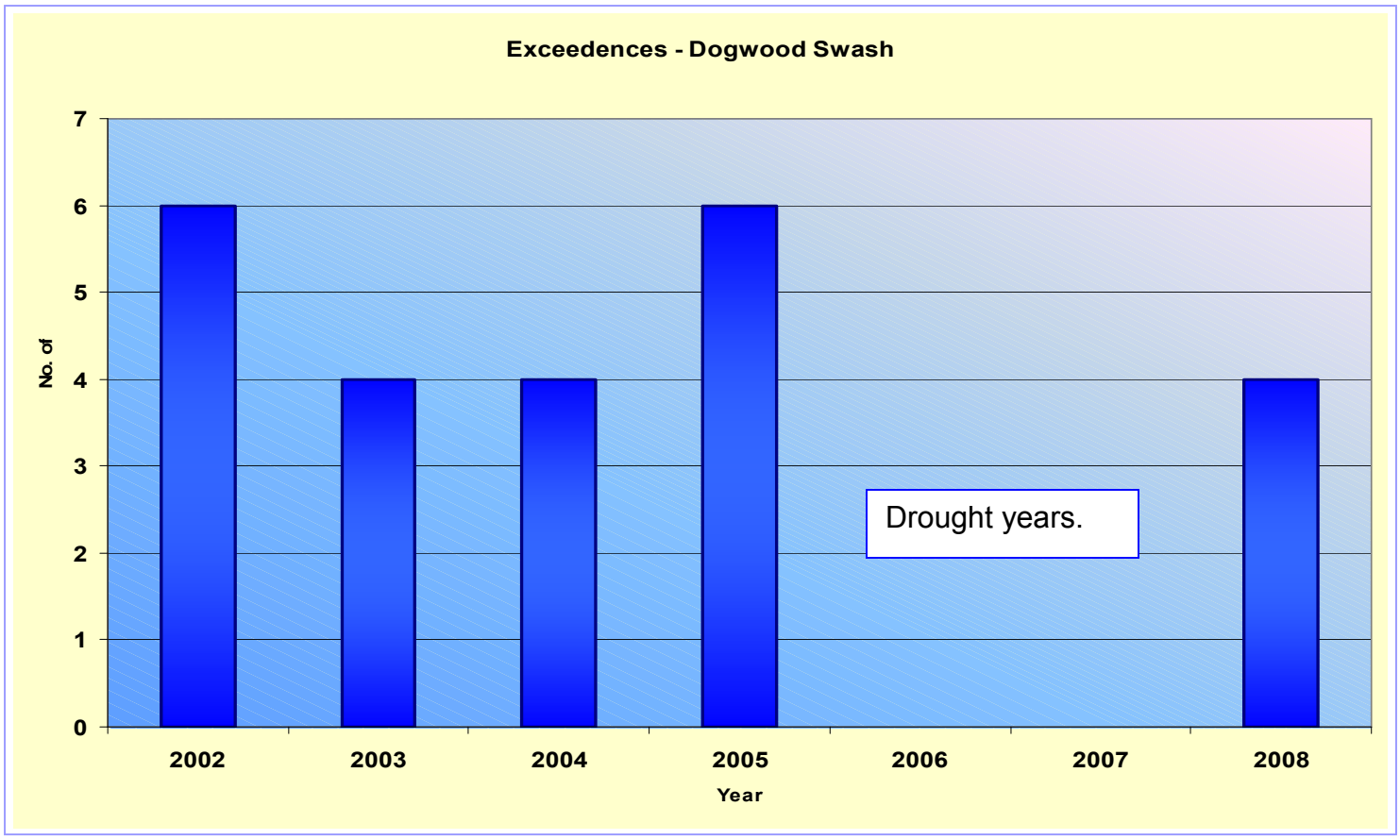


While the cities of North Myrtle Beach and Myrtle Beach opted to install the 1000-foot pipe extension other cities and areas of the county selected different methods to improve water quality.

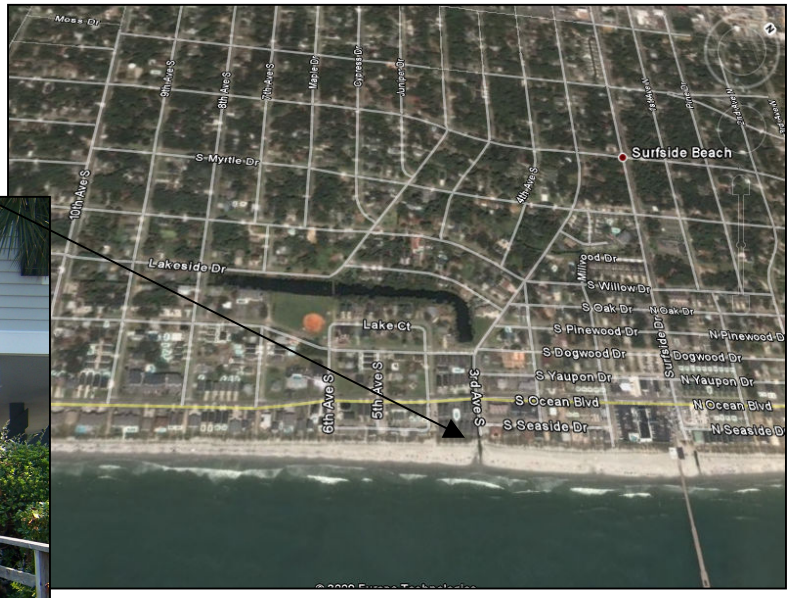
The Town of Surfside Beach noticed that they had advisories on their beaches near swashes. They contacted SC DHEC staff in the Region 6 office for guidance. They made the following changes:

- They implemented a dredging operation to deepen their pond system where stormwater is retained. Deeper ponds mean better attenuation and should improve the water quality of the discharge.
- They encourage residents to stop feeding the geese near the ponds.
- They welcomed the EPA EPI studies in 2009.

Dogwood Swash is at 11th Avenue N in Surfside Beach.



Swash at 3rd Ave S in Surfside Beach



Horry County Stormwater Management group has been working on this issue for over a decade. In 2000, David and Floyd conducted a survey for Horry County. They found contamination was typically worse after rainfall and they found contamination in the soil that was a potential source for surf contamination. They suspected sources of the soil contamination were wild and domestic animals, perhaps human sources such as camper wastewater handling and sewer system overflows and/or malfunctions.

Sediment was tested from the bottom of the lagoons and ponds. The soil and water samples suggested that the enterococcus could reproduce outside the host in the conditions present. Below is table 2.4 from the David and Floyd report that shows the percent enterococcus found - human or animal. Remember the study covered the unincorporated areas of Horry County: Arcadia Beach, Myrtle Beach State Park, Pirateland Campgrounds, Ocean Lakes Campgrounds, and Lakewood Campgrounds.

Sample Location	Date	% Human	% Animal
Wyndam Hotel	9-Jun-00	0.0	100.0
Wyndam Hotel	19-Jun-00	20.8	79.2
Lakewood Campground -1	19-Jun-00	17.4	82.6
Singleton Swash	19-Jun-00	0.0	100.0
Lakewood Campground -2	19-Jun-00	57.9	42.1
Surfside Beach - 1	11-Jul-00	4.3	95.7
Surfside Beach - 2	24-Aug-00	29.2	70.8

Some of the sources the study identified are shown below and suggested solutions:

✓People
✓Horses
✓Dogs
✓Deer
✓Raccoons
✓Ducks
✓Geese
✓Seagulls
✓Other birds

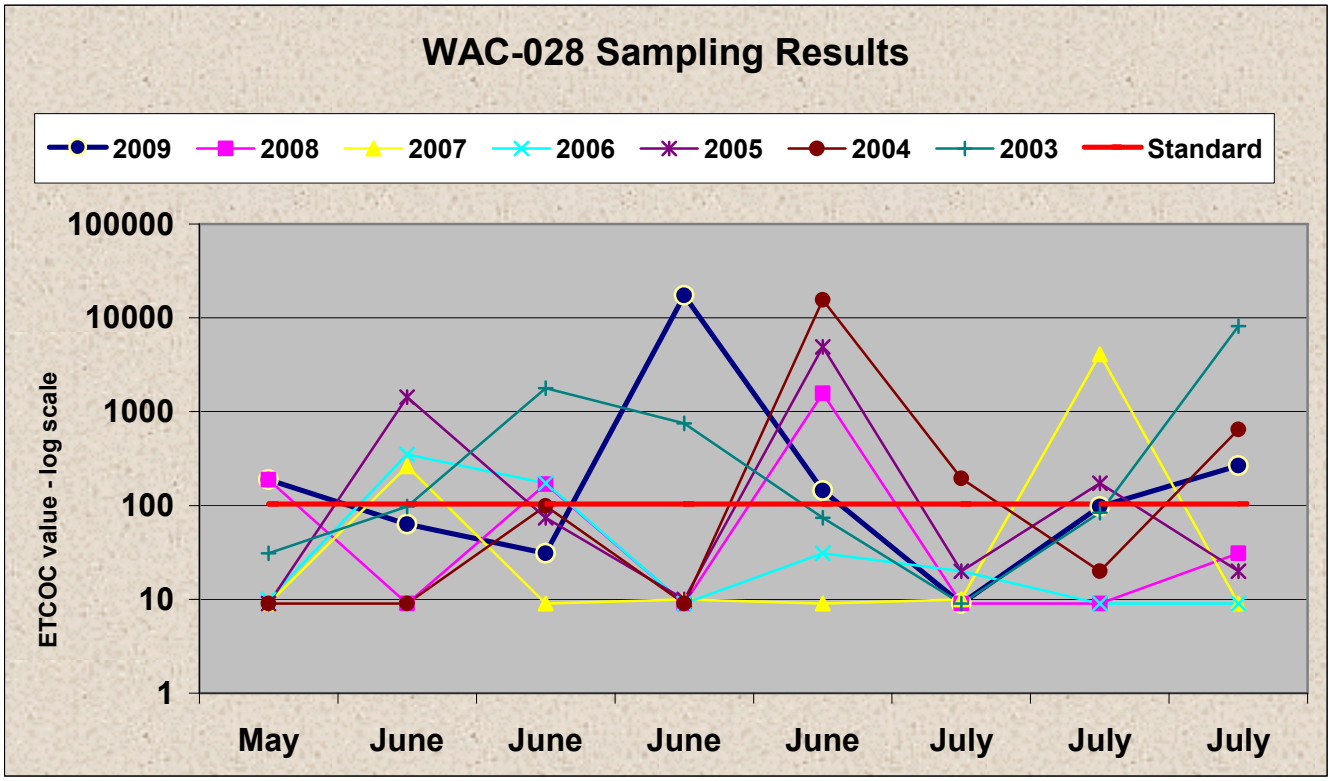
- **Eliminate septic tanks**
- **Improve sewer systems**
- **Improve stormwater drainage**
- **Promote tight seals and proper operation of RV holding tanks**
- **Dredge sediment from ponds**
- **Treat ponds**
- **Pipe outfalls to ocean bottom**
- **Pipe outfalls to ICW**

The suggestion to pipe outfalls to the ICW is not a viable option. SC DHEC Bureau of Water would not permit this project.

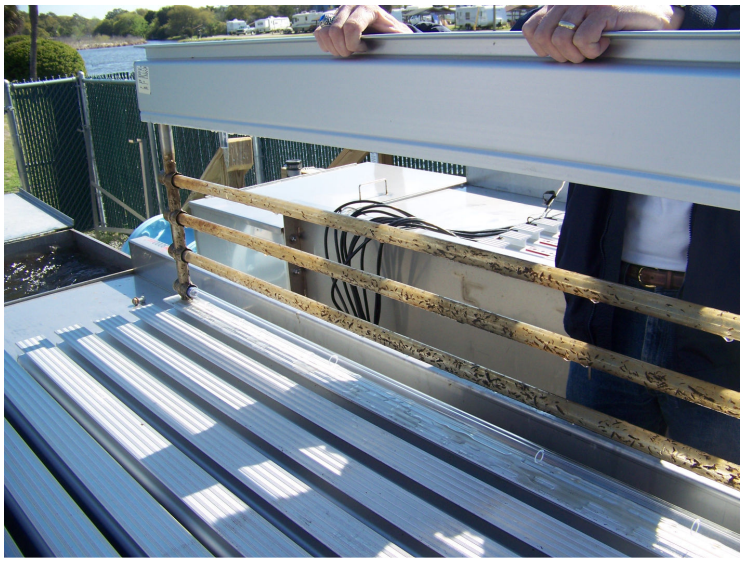
Horry County is in the process of implementing some of the recommended strategies. The plan is to have all but one overflow pipe removed from the unincorporated areas of the County by 2010.

At two of the campgrounds in the County, stormwater managers have worked with campground managers on different approaches to the runoff issue.

Pirateland has a pond which discharges to the ocean through Beaver Dam Creek (WAC-028). The County installed an ultra-violet system to "clean" bacteria from the water prior to discharge to the beach. This system was place in service over the winter of 2008-2009. Here is a chart of the sampling data in 2009 relative to previous years.



Pictures of the UV equipment and its location follow on the next page.



UV array – 4 sets of bulbs. The UV light should kill the bacteria.

Water is taken in from one side of the island and discharged to the other after UV treatment.

Ocean Lakes Campground – Stormwater Infiltration Project

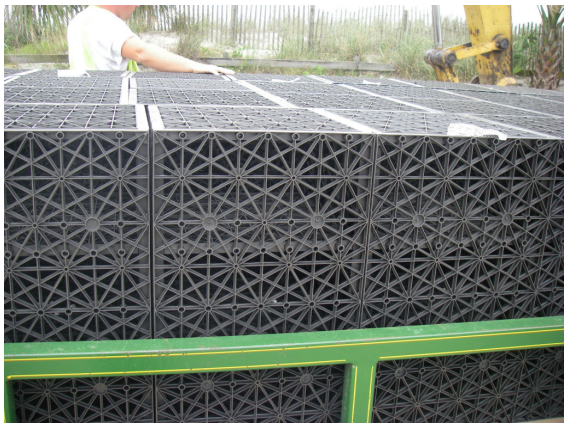
The problem:

The campground has stormwater pipes, which discharge, onto the beach. Over the winter of 2008-2009, Horry County put in an infiltration system. The catch basins will be under the roads in the campground. Grates will allow water to drain into the catch basins instead of discharging through pipes onto the beach. All but one of the current stormwater pipes will be capped and removed from the beach at the dune line. One overflow pipe will remain.

Here are some pictures of this project:

This is the roadway before the project began.

Inserting the catch basin and mesh fabric.



Another of the David and Floyd recommendations was to eliminate swimming in swashes.

Although signs are posted and information is available about the hazards of swimming in swashes, many people still don't know the hazards or choose to swim there anyway. This mother has 4 small children all but the oldest in life jackets. She is able to monitor their activity, the water is warm, and the kids are "safe". Her trade off is to have them all in the ocean. Our challenge is to make our point more effectively.

One way we have tried to get this message out is through permanent signage. Many of the discharge pipes in the cities and in the county now have permanent signs. This is more protective of public health than the temporary advisories issued after sampling. Permanent signs are shown on the next page.

This sign is at WAC-005 in North Myrtle Beach – 3rd Ave. N

Finally, citizens have formed the Withers Estuary Community Collaborative to work with the city of Myrtle Beach, Coastal Carolina University, Street Reach Inform, NOAA, Horry County, The Surfrider Foundation, and others to begin cleaning up the water in Withers Swash.

By re-inserting oyster beds into the area, a natural cleaning process can begin.

A lot of thought and hard work has been given to eliminating or minimizing stormwater discharges in Horry County. We have come a long way from the days when stormwater was not recognized as a public health issue.

We all look forward to the day when the caution signs are not longer needed.

Acknowledgements:

Without the help of the following people this paper could not have been written. Thanks to:

SC DHEC Region 6: Sean Torrens, Ted Ambrose, Rayna King

SC DHEC Bureau of Water: Matt Carswell, Mehir Mehta, PE, Jeff deBessonet, PE, Mark Noble

Horry County Stormwater Management: Tom Garigen, Jackie Taylor, Bob Fletcher

Town of Surfside Beach: Jan Lewis

City of Myrtle Beach: Mark Kruea

Chapin Memorial Library: Barbara Stokes

Thanks to all of you.

Shannon Berry, Program Coordinator, Beach Program, SC DHEC Bureau of Water presented this paper at the 2009 National Beaches Conference.

Contact Shannon at 803-898-3541 or berrysk@dhec.sc.gov.